Physics 222 Demonstrations and Viewgraphs (Fall 1996)

Date	Ch/Sec	Demos	Transparencies	
M 8/26	**19/1-3**	**E&M: M9,10,12,4,30,26,27,5**	**S/19.1,2,3,4,6,7 S/#78 B/29.3,5,8,22 G/29.24**	
	19/1	**Historical Overview; magnets**	B29.3	Cutting magnets
		M9 Common magnetic materials		
		M10 Magnetic effects penetrate materials		
		M12 Floating magnet		
		M4 Permanent magnets		
	19/2	**The magnetic field**	S/19.1	B-field
		M30 Lattice of compass needles; field lines	S/19.2	field lines
		M26 Force on a moving charge (tube)	G/29.24	CRT tube
		M27 Force on a moving charge (scope)	S/19.3,B/29.5	Lorentz force
			S/78,B/29.22	Circular beam path
			S/19.4	right-hand rule
	19/3	**Force on a current-carrying conductor**	S/19.6,B/29.8	Force/wire
		M5 Force on a wire	S/19.7	Interpretation
W 8/28	**19/4**	**E&M: M23,7,8**	**S/19.11 B/29.14,18 G/29.15**	
	19/4	**Torque on a current loop in a B-field**	B/29.14, G/29.15	Torque on a loop
		M23 Torque on a loop	S/19.11	Magnetic moment
		M7 DC motor		
		M8 Galvanometer	B/29.18	Galvanometer
F 8/30	**20/5**	**E&M: M27**	**B/29.23,26,27**	
	20/5	**Combined electric and magnetic fields**	B29.23	helix
	Notes	M27 Force on a moving charge (scope)	B/29.26,27	velocity selector
W 9/4	**19/5-6**	**E&M: M1,21**	**S/19.12,16,17, B/30.4,5,6,7,8**	
	19/5	**Biot-Savart Law**	S/19.12,B/30.5	Biot-Savart law
		M1 B-field due to current on a straight wire	B/30.6,S/19.14	field/long wire
			S/19.16,B/30.7,8	field of loop
	19/6	**Force between two parallel wires**	S/19.17,B/30.4	force/wires
		M21 Force between two wires		
F 9/6	**19/7-8**	**E&M: M2,1,6**	**S/19.19,21,23, B/30.12,15,18**	
	19/7	**Ampère's law**	S/19.19,B/30.15	Ampère's law
		M1 B-field due to current	S/19.21,B30.18	Field/Toroid
	19/8	**The magnetic field of a solenoid**	B/30.12	Solenoid
		N/A Collection of solenoids	S/19.23	Field/solenoid
		M2 Electromagnet		
		M6 Solenoid as bar magnet		

The viewgraph for Serway, Figure 19.14 is missing (printer's error).

Date	Ch/Sec	Demos	Transparencies	
M 9/9	**20/1-2**	**E&M: I1,8,9,14,3,5**	**S/20.1,2,4,6,7,8**	**B/31.3,4,7**
	20/1	**Faraday's Law of Induction**	S/20.1, B/31.3,4	Induction (coil,magnet)
		I1 Induction (coil/magnet, 2 coils)	S/20.2	Faraday's Experiment
		I8 transformer (magic lamp)	S/20.4, B/31.7	Magnetic flux
		I9 transformer (scope)		
		I14 transformer (Jacob's ladder)		
	20/2	**Motional emf**	S/20.6	Motional emf
		I3 generator	S/20.7	sliding bar
		I5 generator, 3 lamps	S/20.8	rotating bar
W 9/11	**20/3-4**	**E&M: I1,4,10,19,6**	**S/20.10,11**	**B/31.16,25**
	20/3	**Lenz's Law**	S/20.10	Lenz's law (sliding bars)
		I1	S/20.11	Lenz's law (magnet)
		I4 back emf, motor	B/31.16	induced emf (generator)
		I10 Lenz's law (jumping ring)	B/31.15	eddy currents
		I19 Lenz's law, Al tube, magnets		
		I6 eddy currents		
	20/4	**Induced emfs and Electric Fields**		
F 9/13	**20/6-8**	**E&M: I11,12,16,17**	**S/20.15,16,17**	**B/32.7,8**
	20/6	**Self-Inductance**		
		I12 choke coil		
		I16 self-inductance		
	20/7	**RL Circuits**	S/20.15, B/32.7,8	RL circuit
		I17 RL circuit on scope	S/20.16	I vs. t in RL circuit
			S/20.17	dI/dt vs. t in RL circuit
	20/8	**Energy Stored in a Magnetic Field**		
M 9/16	**21/1-2,7**	**E&M: LC circuits (undamped)**	**S/21.2,4,5,6, B/32.10, S/24.4,5**	
	21/1	**Simple Harmonic Motion**	S/21.2	x,v,a vs t
	21/2	**Motion of a Mass Attached to a Spring**	S/21.4	mass on a spring
	21/7	**Oscillations in Circuits**	S/21.5	spring: initial conditions
		N/A LC circuits	S/21.6	x,v,a vs. t (initial cond.)
	24/2	**Hertz's discoveries**	B/32.10, S/24.4	LC circuit
			S/24.5	LC oscillations
W 9/18	**21/5,7**	**E&M: LRC circuit (damped)**	**S/21.13**	**B/33.17**
	21/5	**Damped Oscillations**	S/21.13	Mass on spring in water
	21/7	**Oscillations in Circuits**	B/33.17	RLC resonance
		N/A LRC circuits	S/24.5	LC oscillations
F 9/20	**21/6-7**	**E&M: LRC circuit (driven), AC1,8**	**S/21.17**	
	21/6	**Forced Oscillations**	S/21.17	Tacoma bridge
	21/7	**Oscillations in Circuits**	B/15.17	A(ω) for driven oscillations
		AC1 RLC resonance		
		AC8 AM radio (WOI)		

M 9/23	**22/1-6**	**WMS 1,2,3,14**	**S/22.1,3,4,5,12,13,14,15; B/17.3;16.10,11**	
	22/1	**Three Wave Characteristics**	S/22.1	Wavelength, period
		W14 Sounds waves need a medium	B/17.3	Wave fronts, plane waves
	22/2	**Types of Waves**	S/22.3,4,5	Transverse/longitudinal
		W1 Types of traveling waves		
		W2 transverse waves		
		W3 longitudinal waves		
	22/3	**One-dimensional traveling waves**		
	22/5	**The speed of waves on strings**		
	22/6	**Reflection and Transmission of Waves**	S/22.12,13;B/16.10	Reflection open/closed
			S/22.14,15;B/16.11	Media boundary
W 9/25	**22/7-8**	**WMS 42**	**S/22.18**	
	22/7	**Sinusoidal Waves**	S/22.18	Sinusoidal waves
		W42 wave demonstrator		
	22/8	**Energy Transmitted/sinusoidal waves**		
F 9/27	**22/9-11**	**WMS 10,11,45**	**S/22.22,23,24; B/17.2,3,8,9**	
	22/9	**Sound Waves**	S/22.22;B/17.2	Pressure waves
		W10 sounding body in motion		
		W11 motion of a tuning fork		
	22/10	**Doppler effect**	S/22.23,24	Doppler effect
		W45 Doppler effect	B/17.8,9	Doppler effect
	22/11	**Shock waves**	B/17.3	Wave fronts
W 10/2	**23/1-2**	**WMS 2,8,17,42**	**S/22.8(e),9(f); S/23.1,4,5,photo; B/16.6,17**	
	22/4	**Superposition and Interference**	S/22.8(e),9(f)	Superposition of waves
			B/16.6	Superposition
	23/1	**Superposition/IF for harmonic waves**	S/23.1	Superposition/harmonic w
	23/2	**Standing Waves**	S/23.4;B/16.17	Standing waves (superp.)
		W2 Standing waves/rope	S/23.5	Standing waves/string
		W8 Standing sound waves	photo	Standing wave/string
		W42 wave demonstrator		
F 10/4	**23/3-7**	**W9,18,21,22,28,31,35,43**	**S/23.9,11,12; B/17.5,6,11**	
	23/3	**Natural Frequencies/String**		
		W9 Chladni's plates		
		W28 Metallophone		
	23/4	**Resonance**		
		W21 Resonance		
	23/5	**Standing waves in air columns**	S/23.9;B/17.5,6	Air columns
		W31 Overtone pipe		
		W22 sound columns, 2 gases		
	23/6	**Beats: Interference in Time**	S/23.11;B/17.11	Beats
		W43 Beats using 2 function generators		
		W18 Beats (sound)		
	23/7	**Complex waves; Fourier Analysis**	S/23.12	Complex waves
		W35 Fourier synthesis		

M 10/7	**24/1-3**	**AC 6**	**S/24.2,4,5,7 B/34.2,6,17**	
	24/1	**Electromagnetic Waves**	S/24.2,B/34.6	dipole antenna, EM wave
			B/34.17	wave equation
		AC 6 Dipole antenna	B/34.2	displacement current
	24/2	**Hertz's Discoveries**	S/24.4,5	LC circuit, oscillations
	24/3	**Production of EM waves by antenna**	S/24.7	dipole oscillations
W 10/9	**24/4-6**	**H 19**	**S/24.10,13**	**B/34.15**
	24/4	**Energy of an EM wave**	S/24.10	Poynting vector
	24/5	**Momentum and Radiation Pressure**		
		H19 Thermal radiation		
	24/6	**EM Spectrum**	S/24.13, B/34.15	EM spectrum
F 10/11	**25/1-3**	**L3,46,45**	**S/25.2,3,4,6 B/35.7,10**	
	25/1	**Nature of light**		
	25/2	**Ray approximation**	S/25.2	diffraction
		L46 Ray approximation		
	25/3	**Reflection/refraction**	S/25.3	specular reflection
		L3 Refraction of light	S/25.4, B/35.7	incidence=reflection
		L45 Reflection/refraction	S/25.6, B/35.10	Refraction/water
M 10/14	**25/4-7**	**L3,6,10,44,45**	**S/25.13b,14a,19,21,24,26 B/35.24**	
	25/4	**Dispersion and Prisms**	S/25.13b	Prism
		L45 reflection/refraction (prism)	S/25.14a, B/35.24	Prism/spectrum
		L6 prism/spectrum		
	25/5	**Huygen's principle**		
	25/6	**Total internal reflection**	S/25.19	Total internal reflection
		L3 reflection/water tank	S/25.21	Fiber optics
		L10 fiber optics	S/25.24	Reflection/transmission
		L44 total internal reflection	S/25.26	Prof. in the box
	25/7	**Fermat's principle**		
W 10/16	**26/1-2**	**L2,4,5**	**S/26.2,4,6,7,9**	**B/35.30,38a,38b**
	26/1	**Images formed by plane mirrors**	S/26.2, B/35.30	Image formed by mirror
		L2 image by plane mirror		
	26/2	**Images formed by spherical mirrors**	S/26.4	Image/spherical mirror
		L4 spherical mirrors	S/26.6, B/35.38a	concave mirror
		L5 big concave mirror	S/26.7,9	concave mirror
			B/35.38b, S/26.9	convex mirror
F 10/18	**26/3-4**	**L14,46**	**S/26.11,12,14,16,17,20 B/36.5,6,10**	
	26/3	**Images formed by refraction**	S/26.11	image/refraction
		L46 Image by a lens	S/26.12, B/36.10	virtual image/refraction
		L14 aberration	S/26.14	virtual image/water
	26/4	**Thin lenses**	S/26.16	concave/convex lenses
			S/26.17, B/36.5	thin lens equation (convex)
			B/36.6	concave lens
			S/26.20	ray diagram/thin lens

M 10/21	**27/1-3**	**L 21, 22**	**S/27.1,3**	
	27/1	**Conditions for interference**		
		L-21 Michelson interferometer		
	27/2	**Young's double-slit experiment**	S/27.1	Double-slit experiment
		L-22 Double-slit experiment	S/27.3	Geometry of Young's exp.
	27/3	**Intensity distribution for double-slit**		
F 10/25	**27/5-6**	**L 19,48**	**S/27.13,14 photos p.761, 774; S/22.14,15**	
	27/5	**Change of phase due to reflection**	S/27.13	Interference/phase change
	27/6	**Interference in thin films**	photo p.761, 774	soap bubbles, film on water
		L 19 reflected colors from a soap bubble	S/27.14	Newton's rings
		L 48 air wedge between glass plates		
M 10/28	**28/1-3**	**L22**	**S/25.2, 28.4,5,7,10,12**	
	28/1	**Introduction to diffraction**	S/25.2	diffraction
	28/2	**single-slit diffraction**	S/28.4,5	single-slit diffraction
		L22 Fraunhofer diffraction	S/28.7,10	intensity of single slit
	28/3	**resolution of single-slit and circ. apert.**	S/28.12	Rayleigh's criterion
W 10/30	**28/4-6**	**L24,25,27,29,32**	**S/28.15,16,18,20,23-26, photo p. 782, G/38.6,7,10,24**	
	28/4	**The diffraction grating**	S/28.15,16	Diffraction grating
		L24 diffraction grating		
	28/5	**Diffraction of x-rays by crystals**	S/28.18	x-ray diffraction
			G/38.24	x-ray tube
			S/28.20	Bragg planes
	28/6	**Polarization of light waves**		
		L27 P by selective absorption	S/28.23,24	polarizer/analyzer
		L25 P by reflection	S/28.25,G/38.7	Brewster angle
		L32 P by scattering	S/28.26,G/39.6	polarization by scattering
		L29 strain birefringence	ph. p. 782, G/39.10	strain birefringence
F 11/1	**29/1-2**	**L43**	**S/29.1,2,4,5,6,7,9**	
	29/1	**Black-body radiation/Planck's theory**	S/29.1	cavity as a black body
			S/29.2	black-body spectrum
			S/29.4	photons
			S/29.5	Quantized harmonic oscill.
	29/2	**The photoelectric effect**	S/29.6	Photoelectric effect (exp.)
		L43 photoelectric effect	S/29.7	IV curves
M 11/4	**29/3-6**	**None**	**S/29.9-13**	
	29/3	**The Compton effect**	S/29.9,10	Compton effect
	29/4	**Photons and electromagnetic waves**		
	29/5	**The wave properties of particles**	S/29.11	Matter waves
	29/6	**The double-slit experiment revisited**	S/29.12,13	Electron diffraction

W 11/6	**30/1-2**	**None**	**S/11.14;12.19,21;30.1,2;T30.1;B/40.9,14;G/41.22**	
	30/1	**Atomic models**	S/30.1	Thompson's model
			S/30.2	Rutherford model
	11/9	**Quantization of angular momentum**	S/11.14	angular momentum
	29/5	**Wave properties of particles**	S/12.19	Bohr model
	12/5	**Atomic spectra and Bohr model**	S/12.21,B/40.9,40.14	H spectrum
			G/41.22	H spectrum/continuum states
	30/2	**The hydrogen atom revisited**	Table S/30.1	Quantum numbers H-atom
F 11/8	**30/2-3,5-9**	**HeNe Laser** (see-through)	**S/30.10-13,19,21-24, Table 1**	
	30/2	**The hydrogen atom revisited**	Table S/30.1	Quantum numbers H-atom
	30/3	**Spin quantum number**		
	30/5	**Other quantum numbers**	S/30.10	Vector model for L
			S/30.11,12	Stern-Gerlach experiment
	30/6	**Pauli principle, periodic table**	S/30.13	Periodic Table
	30/8	**atomic transitions**	S/30.19,21	emission/absorption
	30/9	**lasers and holography**	S/30.22,23	laser
		HeNe Laser (see-through)	S/30.24	holography
M 11/11	**31/1-6**	**Nuc 1**	**S/31.4-7,9,10,12,13 Table 1,2**	
	31/1	**Some properties of nuclei**	S/T31.1	Nucleons
			S/31.4,5	Nuclear spin
			S/31.6,7	NMR, MRI
	32/2	**Binding energy**		
	31/3	**Radioactivity**	S/31.9,10	radioactivity
	31/4	**Decay processes**	S/31.12,13	alpha decay (tunneling)
		Nuc1 Radioactivity (Geiger counter)	S/T31.2	Decay pathways
	31/5	**Natural radioactivity**		
	31/6	**Nuclear reactions**		
W 11/13	**32/1-11**	**Nuc 3**	**S/32.1-6,10-12; Table 2,4**	
	32/1	**Introduction**		
		Nuc3 Cloud chamber		
	32/2	**Fundamental forces**	S/32.10	four fundamental forces
	32/3	**Positrons and other antiparticles**	S/32.1	pair production
	32/4	**Mesons**	S/32.2,3	gauge boson exchange
	32/5	**Classification of particles**	S/32.Table 2	particle zoo
	32/6	**Conservation laws**		
	32/7	**Strange particles and strangeness**		
	32/8	**The eightfold way**	S/32.4,5	8-fold way
	32/9	**Quarks-finally**	S/32.6, Table 4	quarks and hadrons
	32/10	**The standard model**	S/32.10	standard model
	32/11	**The cosmic connection**	S/32.11,12	cosmology

F 11/15	**13/1-4**	**HS-1,20, Heat-3,5,6,12,30**	**S/13.1-3,5,7,8; Wilson #21**	
	13/1	**Pressure**	S/13.1	Pressure measurement
		HS-1 Hydraulic press	Wilson #21	hydraulic press
		HS-20 Atmospheric pressure		
	13/2	**Temperature**		
		H-12 frozen banana		
		H-30 Liquification of air		
	13/3	**Thermometers/temperature scales**	S/13.2	Celsius scale
		H-5 Differential gas thermometer	S/13.3	gas thermometer
			S/13.5	Kelvin scale
	13/4	**Thermal expansion**		
		H-3 bimetallic strips	S/13.8	bimetallic strip
		H-6 Thermal expansion	S/13.7	Thermal expansion/washer
M 11/18	**13/5-6**	**H43, E&M Nuc-4**	**B/20.11, Wilson #23, Movie K2**	
	13/5	**Ideal gas law**	B/20.11	Non-ideal gases
		H43 Boyle's law		
	13/6	**Kinetic theory of gases**	Wilson #23	kinetic theory
		Nuc-4 Kinetic theory	Movie K2	kinetic theory
F 11/22	**14/1-3**	**H24**	**S/14.2; Wilson #27**	
	14/1	**Heat flow and internal energy**	Wilson #27	calorie/kcal/btu
	14/2	**Specific heat**		
	14/3	**Latent heat and phase change**	S/14.2	Latent heat
		H24 specific/latent heat		
M 12/2	**14/4-5**	**H35**	**S/14.3,5,6**	
	14/4	**Work and thermal energy**	S/14.3	work done by piston
		H35 heat-work	S/14.5	PV-diagrams
			S/14.6	adiabatic vs. irreversible
	14/5	**First law of thermodynamics**		
W 12/4	**14/6**	**H38**	**S/14.3,5,6 (again)**	
	14/6	**Applications of the first law**		
		H38 Cyclic process: dipping duck		

F 12/6	**15/1-2**	**H34,40,44,45**	**S/15.1,4,9**	
	15/1	**Heat engines and second law** H40 solid-phase heat engine H44 thermoelectric converter H45 Nitinol engine	S/15.1	Heat engine
	15/2	**Reversible and irreversible processes** H34 adiab. compression (fire syringe)	S/15.4,9	(ir)reversible processes
M 12/9	**15/3-5**	**H39,47**	**S/15.5-7**	
	15/3	**The Carnot Engine** H39 gasoline/steam engine (display) H47 Stirling engine	S/15.5,6	Carnot cycle
	15/4	**Heat pumps and refrigerators**	S/15.7	heat pump
	15/5	**An alternative statement of 2nd law**		
W 12/11	**15/6-9**	**None**	**S/15.6,9,10**	
	15/6	**Entropy**	S/15.6	Carnot cycle (PV diagram)
	15/7	**Entropy changes in irreversible proc.**		
	15/8	**Entropy on a microscopic scale**	S/15.9	Free expansion
	15/9	**Entropy and disorder**	S/15.10	Order/disorder